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EXAMINER	
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ART UNIT	**PAPER NUMBER**
1795	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/720,280	FUKUDA ET AL.	
	Examiner	Art Unit	
	Alix Elizabeth Echelmeyer	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 May 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12* is/are pending in the application.

4a) Of the above claim(s) *3-7* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,8-12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *4/14/08*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. This Office Action is in response to the amendment filed May 27, 2008. Claims 1, 3, 6, 7, 8, 11 and 12 have been amended. Claims 3-7 were previously withdrawn. Claims 1, 2 and 8-12 are rejected finally for the reasons given below.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1, 2 and 8-12 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claims contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. The limitations introducing new matter are the limitations that have been amended to state that the electrode catalyst layer has a pore volume of 6.06-7.26 μl for each 1 mg of catalyst in the electrode catalyst layer and each 1 cm^2 of the surface area of the catalyst layer. There is no basis for this limitation in the specification because it is not disclosed that each 1 mg of catalyst in the electrode catalyst layer correlates to each 1 cm^2 of the surface area of the catalyst layer. The parameters are not disclosed in a one to one ratio as they are claimed.

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1, 2 and 8-12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In this case, it is unclear what is meant by "pores formed by said pore forming member, equal to or more than 6.0 μl/cm^2 mg catalyst." The examiner cannot understand what is meant by the limitation, and reading of the specification has not shed light on the limitation. For the purposes of examination, an electrode catalyst layer having all other limitations of claim 1 will be determined to meet all limitations of claim 1.

In the response filed September 6, 2007, Applicant attempts to explain the limitation. However, the examiner still does not understand the limitation. The specification, at page 6 lines 8-23, discusses why it is desirable to have a total sum volume of the pores be greater than 6.0 μl/cm^2 mg catalyst. This explanation does not explain what the limitation "total sum volume greater than 6.0 μl/cm^2 mg catalyst" means.

In the amendment filed May 27, 2008, Applicant has changed the limitation to read: "said electrode catalyst layer having pores formed therein … and a total sum volume of the pores that have a pore diameter within a range from 0.01 to 30 μm is, *for each 1 mg of catalyst* in the electrode catalyst layer **and** *each 1 cm^2 of the surface area* of the electrode catalyst layer opposite to the surface in contact with the polymer electrolyte membrane, within the range of 6.06 to 7.26 μl. This amendment does not clarify the claimed limitation.

Based on further consideration of the specification, the examiner believes that Applicant may be trying to claim that, for every 1mg of catalyst or for every 1 cm^2 of the surface area, the volume of pores having diameter within a range from 0.01 to 30 μm (so, it does not include the pores having a diameter outside of that range even though pores outside of that range exist) is within the range of 6.06 to 7.26 μl. However, this does not make sense because the pore volume is then measured based on both the weight of catalyst and the area of the catalyst, but the two factors are not dependent on one another. The specification does not disclose that for every 1 cm^2 of the surface area, there is 1 mg of catalyst. On page 23 of the instant specification, it is disclosed that 0.3 mg/cm^2 catalyst is used to form the cathode electrolyte catalyst layer (third paragraph). Yet the specification fails to disclose the catalyst loading of pores in the claimed range of 0.01 to 30 μm.

6. Claims 1, 2 and 8-12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is unclear whether the ratio of the weight of carbon particles includes the weight of catalyst material in the ratio of weight of ion conducting polymer to carbon particles.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 1 and 2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Denton et al. (US Patent 6,010,606) in view of Asano et al. (WO 02/080294, with US 2004/0121211 A1 relied upon for translation, since the US application is a 371 of the PCT Application) and Gorman et al. (US Pre-Grant Publication 2002/0086195).

Denton et al. teach a porous gas diffusion electrode for use in fuel cells (abstract, column 1 lines 7-10). Denton et al. teach that the electrode comprises a cathode comprising one or more catalyst components, a non-woven network of carbon fibers, and a polymeric substance (column 3 lines 13-21; column 6 lines 10-12).

Denton et al. further teach that the catalyst is a platinum catalyst on carbon black, with the catalyst mixture being 40 wt% catalyst (column 6 lines 58-65). The polymeric substance is a perfluorosulfonic acid, that is also used as the membrane (column 4 lines 12-15; column 7 lines 22-23).

Denton et al. teach that the mix of fibers (carbon particles) and binder (ion-conducting polymer) may be tailored to improve the function of the matrix (column 5 lines 42-53). It would have been obvious to one having ordinary skill in the art at the time the invention was made to adjust the ratio of ion conducting polymer to carbon, since the ratio may be tailored to produce desired characteristics. It has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. MPEP 2144.05 (IIB)

Denton et al. fail to teach a sulfonated polyarylene based polymer as the polymer electrolyte membrane.

Asano et al. teach fuel cell membrane comprising sulfonated polyarylene ([0010]).

Asano et al. further teach that such a membrane is desirable since it suppresses an increase in resistance voltage within the fuel cell ([0020]).

It would be desirable to use the membrane of Asano et al. in the fuel cell of Denton et al. in order to suppress an increase in resistance voltage.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use the membrane of Asano et al. in the fuel cell of Denton et al. in order to suppress an increase in resistance voltage.

Denton et al. in view of Asano et al. teach the components of the catalyst layer of the instant application but fail to teach the specifically claimed pore size.

Gorman et al. teach a water management system for a PEM fuel cell (abstract).

Gorman et al. teach that it is necessary to remove water from the catalyst/membrane interface in order to allow the reactants to reach the catalyst surface; if reactants do not reach the surface, fuel cell performance is decreased. To remove water, a mean pore size of about 20-40 μm is desired ([0013]).

It would be desirable to provide the catalyst layer of Denton et al. in view of Asano et al. with pores of about 20-40 μm to remove water from the catalyst/membrane

interface in order to allow the reactants to reach the catalyst surface, preventing a decrease in fuel cell performance.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the catalyst layer of Denton et al. in view of Asano et al. with pores of about 20-40 μm to remove water from the catalyst/membrane interface in order to allow the reactants to reach the catalyst surface, preventing a decrease in fuel cell performance.

9. Claims 8-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Denton et al. in view of Asano et al. and Gorman et al. (as applied to claim 1, above) and in further view of Formanski et al. (US 2003/0072980).

The teachings of Denton et al., Asano et al. and Gorman et al. as discussed above are incorporated herein.

Regarding claims 8, 9, 11 and 12, Denton et al. in view of Asano et al. and Gorman et al. teach the fuel cell having the claimed components and pore sizes (see above).

With further regard to claims 8, 10, 11 and 12, Denton et al. teach the use of the fuel cell to power vehicles (column 9 lines 8-11).

As for the limitations of claims 8, 10, 11 and 12 directed to the various mean pore sizes, Gorman et al. teach varying the mean pore sizes at the electrode/membrane interface in order to facilitate water removal ([0013]). It would have been obvious to one having ordinary skill in the art at the time the invention was made to determine the

optimum values for mean pore sizes, since Gorman et al. teach that pore size is related to how well water is removed from the electrode/membrane interface. It has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. MPEP 2144.05 (IIB).

Denton et al. in view of Asano et al. and Gorman et al. fail to teach that the oxidant gas has 50% or more relative humidity.

Formanski et al. teach a fuel cell system wherein the relative humidity of the oxidant gas is 50% ([0061]).

Formanski et al. further teach that the relative humidity is a main parameter that must be defined for stable operation of a PEM fuel cell ([0041]).

It would be desirable to define the relative humidity of the oxidant of the fuel cell of Denton et al. in view of Asano et al. and Gorman et al. as 50%, since Formanski et al. teach that the parameter must be defined for stable operation of the fuel cell, and since it is seen in Formanski et al. that a relative humidity of 50% will allow the fuel cell to operate stably.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to operate the fuel cell of Denton et al. in view of Asano et al. and Gorman et al. wherein the relative humidity of the oxidant is 50%, since this parameter must be defined, and since, when the relative humidity is 50%, the operation of the fuel cell will be stable.

Response to Arguments

10. Applicant's arguments filed May 27, 2008 have been fully considered but they are not persuasive.

On pages 11-12, Applicant argues that the amendments currently filed overcome the 112 rejections. The examiner disagrees, as discussed above.

On pages 12-13, Applicant discusses the 103 rejections. In the first full paragraph of page 13, Applicant states that "none of the prior art of record teaches or suggests the total sum volume of pores having a specific pore diameter range as claimed." It is the understanding of the examiner that the claims are not drawn to the total sum volume of pores, and that all pores have a diameter within the claimed range, rather than all of the pores having a diameter within the claimed range have the claimed volume.

Applicant contends that the claimed limitations to the total sum volume of pores within the given range differentiates the instant invention over the prior art. However, the claimed limitation is still not clear to the examiner so it is not possible to determine whether the prior art teaches or renders obvious the claimed total sum volume of pores for pores within the claimed range.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Uchida et al. (JP 09-137622) teach that finding the optimum condition of pore distribution in an electrode catalyst layer comprising a noble metal and

carbon carrier provides superior discharge characteristics and an excellent life characteristic (abstract).

12. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alix Elizabeth Echelmeyer whose telephone number is (571)272-1101. The examiner can normally be reached on Mon-Fri 8-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Susy N. Tsang-Foster can be reached on 571-272-1293. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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